MEMORANDUM

To: Dr. Jeff McGough

From: Michael Malkowski

Date: 4-21-13

Subject: Industrial Service Report

Overview

This document is submitted for the partial fulfillment of credits for CSC 465/467, Senior Design. The following document is a detailed description of the work that I completed over the course of four months at Innovative Systems two years ago. This was my first summer working for Innovative Systems in Rapid City and since then, I have worked on numerous other projects. The most recent project that I worked on was a Senior Design project that consisted of the creation of two mobile apps. The apps were designed for both iOS and Android platforms. I was responsible for the Android side of the production.

The following document was submitted for the requirements of the cooperative education course for the School of Mines.

SOUTH DAKOTA SCHOOL OF MINES AND TECHNOLOGY

COOPERATIVE EDUCATION STUDENT REPORT

Submitted in Partial Fulfillment

of the Requirements for

CP 497

Employed By

Innovative Systems LLC

In

Rapid City, SD

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10-27-11

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INTRODUCTION

This report describes what I have been working on for the past several months at Innovative Systems. In this report, there are two in depth descriptions of projects I have been working on.

Innovative Systems is a provider and developer of telecommunication devices that is based out of Mitchell, SD. They also develop in the areas of electrical engineering, marketing, and software engineering. I am a part of the software engineering team based in Rapid City at the Business Development Center on campus at South Dakota School of Mines and Technology.

During this past summer, I have learned several skills that helped me to benefit my goal of achieving a computer science degree as well as developing skills to help benefit Innovative Systems. I have learned the languages of C# and XAML. I also learned about architectural patterns such as MVVM, which is popular amongst GUI programmers.

At the beginning of the summer, my task was to learn to program in C# and how it works. Once that was accomplished, I was placed on a team of two to work on the development of phone applications. Innovative Systems has two different smart phone development teams; the Apple team and the Windows team, each with two members. I was assigned to the Windows side and inherited a senior design project from the previous year. To get a better understanding on how the application development on the Windows Phone 7 worked, we actually made our very own apps.

TERMINOLOGY

MVVM – (Model, View, View Model) a type of programming pattern

IPTV – Internet Protocol Television

STB – Set Top Box

APmax – Central hub for communication of STBs, internet, and smart phones

WPF – Windows Presentation Foundation

WCF – Windows Communication Foundation

WP7 – Windows Phone 7

SQL – Structured Query Language,

Tombstone – Saving the state of an app instead of creating new instance

BACKGROUND

Before I can get too in depth about my projects, there needs to be some explanation about a very unique piece of hardware at Innovative Systems. This device is called an APmax.

The APmax serves as a central hub for information and communication between STBs, the internet, and the smart phones. This unit is manufactured by Innovative Systems and is sold to clients throughout the United States. The APmax unit is important to programmers because it makes it easy to send and receive data between smart phones and STBs.

With this ease of information transfer, we are able to communicate flawlessly between the STBs and WP7 so that our information gets to the destination as quickly as possible. This way, we can set a recording on the phone, and see the result in seconds on the STB and vice versa.

PROJECT OVERVIEW

There are several ways that users can interact with their set top boxes. Innovative Systems provides apps on each of the smartphone platforms; Android, Apple iOS, and Windows WP7. Through these apps, Innovative Systems provides a unique experience for their customers.

There have been a couple of projects that my partner, Kevin Worner and I have been assigned to work on this summer. The first of these projects was the Senior Design Project for an app that let you control your set top box from your phone. You can do anything from setting recordings for your STB to viewing a virtual guide on your phone. This app deals heavily with the APmax, because this is where the phone gets all of it's information. On this app, you can set your favorite channels, record shows on your STB, and even change the channel and other remote functions all from your smartphone!

The other application that I was assigned is called a Phone Service Manager. This app is used for managing any voicemails that are saved under the user's account on the APmax. From this app, you can listen to your voicemail as well as mark them as read and delete them. This app also manages something called Single Number.

Single Number is something offered by Innovative Systems and it is very similar to call forwarding. From this app, you can set up phone numbers to forward to as well as set a schedule for each one. Let's say somebody tries to call you at home during the work week between 8-5. The Single Number program checks the schedule and sees that you want this call sent to your work phone after so many seconds of ringing on your home phone.

PROJECTS

DVR CONTROLLER

This DVR Controller app for WP7 was assigned last year to a Senior Design team. Their task was to create an application that put all of the functionality of a set top box onto an app for the WP7. This app contained several app pages and thousands of lines of code when we inherited it. We have made a couple of new versions branching off from the original and I will give you a brief explanation of the layout of the most current version.

In the current version of the app, we have an ample amount pages varying from a single page to something called a pivot page. A pivot page can be best described as window panes side by side. The user can access these panes through a swiping motion. On several of these pages, we have a popup that provides more options for the user. Figure 1 shows the menu page for the start-up of the app.

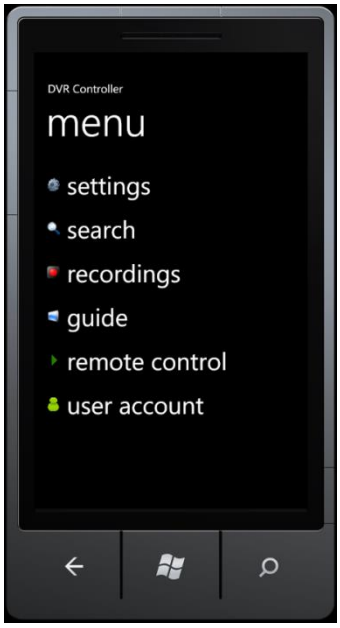

FIGURE 1 MENU PAGE

The Settings page contains a link to the Favorites page that sets the favorite channels locally to the phone separate from the STB. This page also contains the ability to change set top boxes within each account because there can be several STBs within a household. This page also displays which current STB you are controlling.

The search page is a pretty basic page that searches for the closest match to the inputted text. The only requirement for this search is that it requires more than just one letter to search. Next, the app displays the closest matched information to the screen and from there, you can select an individual show for more details and record the show if you so desire. There is also a way of filtering the channels for HD shows, new shows, and even both HD and new.

The recordings page is one of the pivot pages that span three pages in this app. These pages are divided into current recordings, which are recordings that have already been recorded, future and then series recordings. Figure 2 shows what the current recordings page looks like. From these pages, you can select the show for details and even cancel or delete recordings from your phone and the app will remove these recordings from your STB. Also, when you set recordings, you can assign them to a folder. On the recordings page, you can filter the view by opening different folders and then change it back to the default all recordings option. The default list order of the recordings is by the most recent date, but this page also gives you the option to sort the recordings list by date, name, or channel.

FIGURE 2 CURRENT RECORDINGS

Next on the menu page is the guide page. This is where a major bulk of the coding is located and is where I have spent most of my time programming. Being able to get a fully functional guide on your smartphone in seconds is something that amazes me.

When you enter the guide page for the first time, you get the display of the default date, which would be the current date, and channel number one. Once you make a selection, the app saves this and uses it for the next time. For example, if you choose a new channel, let's say channel 7, and a new date, next week Monday, the app's guide will display the show for channel 7 for next Monday. But when you back out of the page or even log out, the information will still be saved. When you go back into the app and select the guide page, it will still have the display of channel 7 for next Monday. Of course, there are various amounts of error checking to see if that date is in the past. For example, if you were to select todays date for the guide and come back tomorrow, the app would check to see if the guide date is still valid. Since it is in the past, the guide automatically updates the time to the current date and displays the shows for the saved channel for the current date. There is also a filter on the channel select screen that lets you choose between your favorite channels, which you save on the favorites page from the settings, or the full guide.

The main part of my duties this summer was to upgrade the code to a releasable version, and to maintain the rest of the code for these changes. When we received this project, the guide page displayed guide data day by day. Unfortunately, the user interface was very slow, because it had to go out and retrieve more information each time the user tried to scroll up or right through the list. So we implemented a system that displays only one channel for one whole day. This way, the user can easily scroll up and down though the hours or the day and this also makes it easier to choose what channel they want. The default guide page is the first channel on the current date. Once the user makes a change, this changed will be saved for the next time they come to the guide page, even if the user logs out.

The guide page also has the ability to select a show for further details and actions. Once you select a show, you can either select to record it once or set up a series recording, just like the search page. Movies, on the other hand, can only be set up for a single recording. Once you select to record, you can assign your recording to a folder, which can be used on the recordings page. You can also see whether or not you have a recording set up or not on the guide page. Figure 3 demonstrates what this looks like. Once you select a show that already has a recording set up, you will have the option to delete this recording.

FIGURE 3 GUIDE PAGE WITH RECORDINGS

The user account page is where the user can log in or out of this app or change between accounts. If there is no user logged in, all of the menu choices, except the user account link, are greyed out. On this page, there are three input textboxes: the user account, the password for that account, and the address to the carrier's website or their IP address. The user also has the option to save their login information so that they don't have to login in every time they close the app. Once logged in, you have the option to change the password for your current account. There is also a link to the help page from the user account screen. This help page provides the descriptions for the different recording icons and also describes the differences in the guide colors.

The remote page has been our pride and joy over the summer. This was the one feature that was added completely new and built from the ground up. Our job was to emulate the STB remote on the WP7. We had to add all of the functionality of the STB remote onto the phone.

All we needed was the list for what each of the remote commands sends to the STB. Once we had this, we needed to manipulate that code in a way that the STB could read it and then send this command to the STB from the phone. The final result was the ability to change your STB channels, navigate the menus, or pretty much anything that your remote can do on your phone from anywhere that had internet connection.

FIGURE 4 REMOTE PAGE

Another major part of my duties was to change the whole user experience when they use the app. By this, I mean how the user is logged in or out to re-get the login token. Each login token is good for 24 hours. Previously, when the user tombstoned or backed out of the app, but was still logged in, the app prompted that the token has expired and you need to log in again to get a new one. This proved to be quite cumbersome and quite frankly annoying. So I had to change this to a different specification. The improved way was to automatically get the new token from the APmax whenever the user was still logged in. This way, the user doesn't have to physically log back in, because we just acquire the new key for them automatically.

PHONE SERVICE MANAGER

I was quite excited to receive this project because this was my very first project, outside of school, that was 100% me. I, with guidance from the Rapid City Manager Dave Springhetti, set up the entire layout from scratch. Being able to set up an entire application was a great

experience for me. This app is not completely finished yet. We had a release due for the DVR controller, so this project is still in development.

My job was to implement an interface that mimics the existing internet service for this application. There are two main parts of this project, the voicemail menu and the call management menu, depending on the individual user's account. Both of these menus contain several other pages to simulate the functionality of the website. The user account page to log in and out is roughly the same as the DVR Controller.

The voicemail menu is a pivot page that contains the ability to manage voicemails by listening to them, marking them as read, or deleting them. The user can also do these processes on the website, and see the changes on their phone as well. On the second part of the voicemail pivot page, there is the settings menu. This contains all of the links to the general settings for the voicemails. These links include the general settings, the order of the voicemails in the list, how to receive notifications about new voicemails, and also a refresh voicemails option.

FIGURE 5 CALL MANAGEMENT

The call management page is another pivot page with the main view containing phone numbers, and the second panel contains the settings. The phone numbers are divided up into groups by assigning group numbers. From here, you can choose to add a new number, edit an existing number, or delete a number. The user can edit the individual numbers to have a certain ring time or to assign a call schedule as well as other options. The general settings

for this page include enabling or disabling this service, forward the call to voicemail, and changing the admin PIN.

CONCLUSION

Over this past summer, I have worked on two applications on the Windows Phone 7 for Innovative Systems. These applications include the DVR Controller and also the Phone Service manager. We have a couple of working versions of the DVR Controller app and even though the Phone Service manager has yet to be completed, the main framework is set up and ready to go.

The futures of these apps consist of a few things. The only thing left for the Phone Service manager is to attach the service calls necessary to make this a fully functional app that is linked to the provider's website. Once this is accomplished, there will be some error checking and conversions to make this work for the current framework. As for the DVR Controller, we plan to download a database that contains all of the necessary information rather than to make service calls to go and get the information every time. This will boost the speed of the app considerably. Once this is completed, there will have to be some conversion to make this fit in with the rest of the app.

When both of these apps are completed, they will greatly change how a customer interacts with their set top box.

REFLECTION

Working for Innovative Systems has been a great experience for me and I am definitely grateful to have received the internship. This has definitely expanded my knowledge of working on a team and to see what I am learning in school applies to the world outside of school. We do projects in school that mimic something we could possibly do outside of school, but it was really a good learning experience to actually do a project that uses my schooling.

During my time at Innovative Systems, I have used knowledge from several of my classes including Computer Science II, Data Structures, and also Analysis of Algorithms. My previous knowledge of lists, classes, and runtime analysis definitely helped me to develop the code in a way that was more efficient in both time and space than I could before.

I am also learning a lot from this internship because I am acquiring knowledge that I will be able to use for my computer science classes to come. We are in the process of transferring how we use the data on the WP7 from internet service calls to an internal SQLite database which can be downloaded to the phone. This deals with writing SQL queries, which is a part of Database Management Systems, CSC 484. I am also finding aspects of my work in some of my friends' assignments for Graphic User Interface, CSC 421.

In my opinion, one of the greatest things about being a computer science major is the ability to see your implemented code go into something that will be widely used by other people. I am definitely grateful to receive the opportunity to apply my knowledge to a team project and grateful to have learned so many things that I will be able to use in the future to help me to complete my computer science degree.